

CLAIMS

What is claimed is:

1. A method for stereolithographically fabricating at least one object, comprising:
placing at least one object release element on a platen of stereolithographic fabrication equipment;
stereolithographically fabricating a first layer of the at least one object directly on said at least one object release element;
stereolithographically fabricating a remainder of the at least one object;
removing said at least one object release element from said platen; and
removing said at least one object release element from the at least one object.
2. The method of claim 1, further comprising:
providing a coating comprising nonstick material on at least a portion of an upper surface of said platen prior to said placing.
3. The method of claim 2, wherein said providing comprises providing a coating comprising a fluorine-containing polymer on at least said portion of said upper surface.
4. The method of claim 3, wherein said providing comprises vapor depositing said fluorine-containing polymer onto at least said portion of said upper surface.
5. The method of claim 1, wherein said placing comprises placing at least one object release element comprising an adhesive coating on said platen.
6. The method of claim 5, wherein said placing comprises placing said at least one object release element with said adhesive coating thereof comprising an at least partially uncured material.

7. The method of claim 6, wherein said removing said at least one object release element from said platen comprises substantially curing said adhesive coating.

8. The method of claim 6, wherein said placing comprises placing said at least one object release element with said adhesive coating thereof comprising an at least partially uncured light-curable material.

9. The method of claim 8, wherein said removing said at least one object release element from said platen comprises exposing said light-curable material to at least one wavelength of curing radiation.

10. The method of claim 8, wherein said placing comprises placing said at least one object release element with said adhesive coating thereof comprising an at least partially uncured ultraviolet-curable material.

11. The method of claim 10, wherein said removing said at least one object release element from said platen comprises exposing said ultraviolet-curable material to ultraviolet radiation.

12. The method of claim 1, wherein said placing includes securing said at least one object release element to said platen with a negative pressure.

13. The method of claim 12, wherein said removing said at least one object release element from said platen comprises reducing an amount of said negative pressure applied to said at least one object release element.

14. The method of claim 1, wherein said placing comprises placing at least one object release element with a surface that includes a material to which at least partially consolidated material adheres during said stereolithographically fabricating said first layer and said remainder

and which is readily removable from the at least one object following completion of said stereolithographically fabricating said remainder.

15. The method of claim 14, wherein said placing comprises placing at least one object release element that includes a surface which comprises at least one of polyethylene, polyethyleneteraphthalate, and polyethylene ethyl ketone on said platen.

16. The method of claim 1, wherein at least one of said stereolithographically fabricating said first layer and said stereolithographically fabricating said remainder of the at least one object comprises selectively exposing regions of at least one layer comprising unconsolidated material to focused consolidating energy to at least partially consolidate material in said regions.

17. The method of claim 16, wherein said selectively exposing comprises selectively exposing regions of at least one layer of uncured photopolymer to at least one wavelength of electromagnetic radiation appropriate for at least partially curing said uncured photopolymer in said regions.

18. The method of claim 17, wherein said selectively exposing comprises selectively exposing regions of at least one layer of ultraviolet-curable polymer to a beam comprising ultraviolet radiation.

19. The method of claim 1, wherein said removing said at least one object release element from the at least one object includes peeling said at least one object release element from the at least one object.

20. The method of claim 1, wherein said removing said at least one object release element from the at least one object includes:
reducing adhesion of said at least one object release element from at least one region of a surface of the at least one object; and

pulling the at least one object from said at least one object release element.

21. Apparatus for facilitating removal of at least one stereolithographically fabricated object from a platen of stereolithographic fabrication equipment, comprising:
a substrate including an upper surface and a lower surface; and
an adhesive coating on at least a portion of said lower surface, said adhesive coating comprising
a material that will secure said substrate to the platen during a stereolithographic
fabrication process and facilitate ready removal of said substrate and the at least one
stereolithographically fabricated object from the platen following said stereolithographic
fabrication process.

22. The apparatus of claim 21, wherein said substrate comprises a material to which
the at least one stereolithographically fabricated object will adhere during fabrication thereof and
which may be pulled from the at least one stereolithographically fabricated object following
fabrication thereof.

23. The apparatus of claim 22, wherein said substrate comprises at least one of
polyethylene, polyethyleneteraphthalate, and polyethylene ethyl ketone.

24. The apparatus of claim 21, further comprising:
an object release coating on at least a portion of said upper surface, said object release coating
comprising a material to which the at least one stereolithographically fabricated object
will adhere during fabrication thereof and which may be pulled from the at least one
stereolithographically fabricated object following fabrication thereof.

25. The apparatus of claim 24, wherein said object release coating comprises at least
one of polyethylene, polyethyleneteraphthalate, and polyethylene ethyl ketone.

26. The apparatus of claim 21, wherein said substrate is substantially planar.

27. The apparatus of claim 21, wherein said upper surface is substantially planar.

28. The apparatus of claim 21, wherein said upper surface is contoured.

29. The apparatus of claim 21, further comprising:

a nonstick coating on at least a portion of the platen, said nonstick coating configured to be positioned adjacent to said adhesive coating.

30. The apparatus of claim 29, wherein said nonstick coating comprises a fluorine-containing polymer.

31. The apparatus of claim 29, wherein said adhesive coating comprises a curable polymer which is tacky when in an at least partially uncured state and is not tacky when in a substantially cured state.

32. The apparatus of claim 31, wherein said adhesive coating will not adhere to said nonstick coating when in said substantially cured state.

33. The apparatus of claim 31, wherein said adhesive coating comprises a light-curable polymer.

34. The apparatus of claim 33, wherein said light-curable polymer comprises an ultraviolet-curable polymer.

35. A stereolithographically fabricated object including a plurality of at least partially superimposed, contiguous, mutually adhered layers that comprise photopolymer, the object comprising:

an unfinished lowermost surface having substantially the same surface features as a lowermost surface of the stereolithographically fabricated object in finished form.

36. The stereolithographically fabricated object of claim 35, wherein said unfinished lowermost surface is substantially free of prefabrication remnants.

37. The stereolithographically fabricated object of claim 35, wherein said unfinished lowermost surface is substantially planar.

38. The stereolithographically fabricated object of claim 35, wherein said unfinished lowermost surface is nonplanar.

39. The stereolithographically fabricated object of claim 35, comprising at least one feature that protrudes beyond a plane of said unfinished lowermost surface.

40. The stereolithographically fabricated object of claim 35, further comprising: an object release element on said unfinished lowermost surface.

41. The stereolithographically fabricated object of claim 40, wherein an upper surface of said object release element which is in contact with at least a portion of said unfinished lowermost surface comprises a material that is readily removable from said unfinished lowermost surface.

42. The stereolithographically fabricated object of claim 41, wherein a lower surface of said object release element has an adhesive coating on at least a portion thereof.

43. The stereolithographically fabricated object of claim 42, wherein said adhesive coating is substantially cured.

44. The stereolithographically fabricated object of claim 43, wherein said adhesive coating is not tacky.

45. The stereolithographically fabricated object of claim 35, wherein said unfinished lowermost surface requires no more than substantially the same degree of finishing as other surfaces of the stereolithographically fabricated object.

46. A stereolithographic fabrication system, comprising:
a fabrication tank;
a platen within said fabrication tank and including a support surface;
a nonstick coating on at least a portion of said support surface; and
an object release element positioned over said support surface and including an adhesive coating on at least a portion of a lower surface thereof, said adhesive coating securing said object release element to said nonstick coating.

47. The stereolithographic fabrication system of claim 46, wherein said fabrication tank is configured to contain a quantity of unconsolidated material.

48. The stereolithographic fabrication system of claim 47, wherein said unconsolidated material comprises ultraviolet-curable material.

49. The stereolithographic fabrication system of claim 46, wherein said nonstick coating comprises a fluorine-containing polymer.

50. The stereolithographic fabrication system of claim 46, wherein said object release element includes a substrate with an upper surface to which at least one stereolithographically fabricated object will adhere during fabrication thereof and which is readily removable from the at least one stereolithographically fabricated object following fabrication thereof.

51. The stereolithographic fabrication system of claim 50, wherein said substrate comprises a material to which the at least one stereolithographically fabricated object will adhere during fabrication thereof and which is readily removable from the at least one stereolithographically fabricated object following fabrication thereof.

52. The stereolithographic fabrication system of claim 51, wherein said substrate comprises at least one of polyethylene, polyethyleneteraphthalate, and polyethylene ethyl ketone.

53. The stereolithographic fabrication system of claim 50, further comprising: an object release coating on at least a portion of an upper surface of said substrate, said object release coating comprising a material to which the at least one stereolithographically fabricated object will adhere during fabrication thereof and which is readily removable from the at least one stereolithographically fabricated object following fabrication thereof.

54. The stereolithographic fabrication system of claim 53, wherein said object release coating comprises at least one of polyethylene, polyethyleneteraphthalate, and polyethylene ethyl ketone.

55. The stereolithographic fabrication system of claim 46, wherein said adhesive coating comprises a polymer which is tacky when in an uncured state and nontacky when in a substantially cured state.

56. The stereolithographic fabrication system of claim 55, wherein said polymer comprises a light-curable polymer.

57. The stereolithographic fabrication system of claim 56, further comprising: a source of electromagnetic radiation of at least one wavelength that will cure said light-curable polymer.

58. The stereolithographic fabrication system of claim 56, wherein said light-curable polymer comprises an ultraviolet-curable polymer.

59. The stereolithographic fabrication system of claim 55, wherein, when in said substantially cured state, said adhesive coating will have reduced adhesion to said nonstick coating.

60. A method for removing a stereolithographically fabricated object from a support surface of a platen of stereolithographic fabrication equipment, comprising:
removing unconsolidated material from at least a portion of the stereolithographically fabricated object;
removing an object release element upon which the stereolithographically fabricated object is carried from a platen; and
removing the stereolithographically fabricated object and said object release element from said platen.

61. The method of claim 60, wherein said removing said object release element comprises reducing adhesion of said object release element to said platen.

62. The method of claim 61, wherein said reducing adhesive comprises substantially curing a quantity of adhesive that secures said object release element to said platen.

63. The method of claim 62, wherein said substantially curing comprises exposing a light-curable adhesive between said object release element and said platen to at least one curing wavelength of electromagnetic radiation.

64. The method of claim 63, wherein said substantially curing comprises exposing an ultraviolet-curable adhesive between said object release element and said platen to ultraviolet radiation.

65. The method of claim 60, wherein said removing said object release element comprises reducing an amount of negative pressure applied to said object release element through said platen.

66. The method of claim 60, further comprising:
removing said object release element from the stereolithographically fabricated object.
67. The method of claim 66, wherein said removing said object release element
comprises peeling said object release element from the stereolithographically fabricated object.
68. The method of claim 66, wherein said removing said object release element
comprises:
reducing adhesion of said object release element to the stereolithographically fabricated object;
and
pulling the stereolithographically fabricated object off of remaining adherent portions of said
object release element.
69. Apparatus for facilitating removal of at least one stereolithographically fabricated
object from a platen of stereolithographic fabrication equipment, comprising:
a substrate including an upper surface and a lower surface and comprising a material to which
the at least one stereolithographically fabricated object will adhere during fabrication
thereof and which may be pulled from the at least one stereolithographically fabricated
object following fabrication thereof.
70. The apparatus of claim 69, wherein said substrate comprises at least one of
polyethylene, polyethyleneteraphthalate, and polyethylene ethyl ketone.
71. The apparatus of claim 69, further comprising:
an object release coating on at least a portion of said upper surface, said object release coating
comprising a material to which the at least one stereolithographically fabricated object
will adhere during fabrication thereof and which may be pulled from the at least one
stereolithographically fabricated object following fabrication thereof.

72. The apparatus of claim 71, wherein said object release coating comprises at least one of polyethylene, polyethyleneteraphthalate, and polyethylene ethyl ketone.

73. The apparatus of claim 69, wherein said substrate is substantially planar.

74. The apparatus of claim 69, wherein said upper surface is substantially planar.

75. The apparatus of claim 69, wherein said upper surface is contoured.

76. The apparatus of claim 69, further comprising:
an adhesive coating on at least a portion of said lower surface, said adhesive coating comprising a material that will secure said substrate to the platen during a stereolithographic fabrication process and facilitate ready removal of said substrate and the at least one stereolithographically fabricated object from the platen following said stereolithographic fabrication process

77. The apparatus of claim 76, wherein said adhesive coating comprises a curable polymer which is tacky when in an at least partially uncured state and is not tacky when in a substantially cured state.

78. The apparatus of claim 77, wherein said adhesive coating will not adhere to said nonstick coating when in said substantially cured state.

79. The apparatus of claim 77, wherein said adhesive coating comprises a light-curable polymer.

80. The apparatus of claim 79, wherein said light-curable polymer comprises an ultraviolet-curable polymer.

81. The apparatus of claim 69, wherein said lower surface is configured to be secured to a surface of the platen as negative pressure is applied thereto through the platen.

82. The apparatus of claim 81, wherein said lower surface is configured to seal against the surface of the platen as the negative pressure is applied thereto.

83. A stereolithographic fabrication system, comprising:
a fabrication tank;
a platen within said fabrication tank and including a support surface and at least one port through which a negative pressure may be applied to said support surface; and
an object release element positioned over and secured to said support surface with said negative pressure.

84. The stereolithographic fabrication system of claim 83, wherein at least a lower surface said object release element comprises a material that seals against said support surface at least when said negative pressure is applied to said lower surface.

85. The stereolithographic fabrication system of claim 83, wherein said fabrication tank is configured to contain a quantity of unconsolidated material.

86. The stereolithographic fabrication system of claim 85, wherein said unconsolidated material comprises ultraviolet-curable material.

87. The stereolithographic fabrication system of claim 83, wherein said object release element includes a substrate with an upper surface to which at least one stereolithographically fabricated object will adhere during fabrication thereof and which is readily removable from the at least one stereolithographically fabricated object following fabrication thereof.

88. The stereolithographic fabrication system of claim 87, wherein said substrate comprises a material to which the at least one stereolithographically fabricated object will adhere

during fabrication thereof and which is readily removable from the at least one stereolithographically fabricated object following fabrication thereof.

89. The stereolithographic fabrication system of claim 88, wherein said substrate comprises at least one of polyethylene, polyethyleneteraphthalate, and polyethylene ethyl ketone.

90. The stereolithographic fabrication system of claim 87, further comprising: an object release coating on at least a portion of an upper surface of said substrate, said object release coating comprising a material to which the at least one stereolithographically fabricated object will adhere during fabrication thereof and which is readily removable from the at least one stereolithographically fabricated object following fabrication thereof.

91. The stereolithographic fabrication system of claim 90, wherein said object release coating comprises at least one of polyethylene, polyethyleneteraphthalate, and polyethylene ethyl ketone.